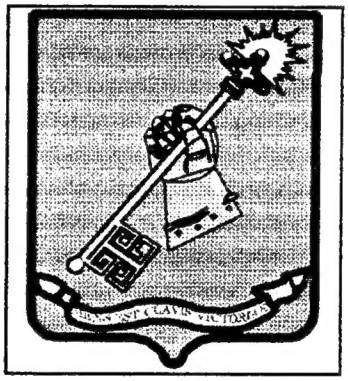
LONGBOW, COMANCHE, and the Aviation Restructure Initiative: Tactical Implications for the Heavy Division Attack Helicopter Battalion

A Monograph
by

Major Richard C. Stockhausen
Aviation



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ABSTRACT

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Over the past thirty years, the attack helicopter has matured as an integral part of the U.S. Army's warfighting team. Operation Desert Storm put the stamp of success on three decades of attack helicopter development, beginning during the Vietnam War. The new world order, however, is sweeping away the environment that shaped the evolution of the Army's attack helicopter. The 21st century promises to bring radical change to the conventional battlefield, requiring units to anticipate and adapt to the new requirements. Army Aviation already has plans for restructuring and modernizing the heavy division attack helicopter battalion to prepare it for the battlefields of the next century.

This monograph examines the projected evolution of the heavy division attack helicopter battalion over the next two decades. It assesses the effect of the Aviation Restructure Initiative, the fielding of the AH-64D APACHE LONGBOW, and the fielding of the RAH-66 COMANCHE on the battalion's combat potential. The analysis revealed significant gains in combat potential with the fielding of both the AH-64D and the RAH-66. It found, however, that the COMANCHE provides the battalion a dramatically better capability to conduct precise, synchronized operations than does the APACHE LONGBOW. The RAH-66 can build a more refined situational awareness of the battle space for the battalion, which is a critical requirement of the future conventional battlefield.

This monograph concludes that the RAH-66 is the helicopter that will enable the attack helicopter battalion to play a dominant role on the 21st century battlefield.

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TABLE OF CONTENTS

I. Introduction

"Division . . . commanders fight combined arms battles and engagements employing every tactical means available."

FM 100-5, Operations[1]

The Past . . . .

On the night of 29 October 1965, three 'Blues' platoons of 1st Squadron, 9th Cavalry found themselves besieged in their patrol base in the Ia Drang valley. At 11:15 PM., the 8th Battalion, 66th North Vietnamese Army Regiment mounted an assault that threatened to overwhelm the tiny patrol base. For the first time, the 1st Cavalry Division committed helicopter gunships to the close support of ground troops at night. Over the next several hours, the fire from these gunships helped relieve the pressure so that 1st Squadron could extract its platoons.[2] On the night of 26 February 1991, elements of A Troop, 1st Squadron, 1st Cavalry found themselves pinned down by a brigade of the Adnan Republican Guards Division. The 1st Armored Division quickly committed 3rd Battalion, 1st Aviation Regiment (Night Eagles) to the fight. Over the next several hours, the Night Eagles' attack helicopters destroyed the Adnan brigade and relieved the pressure on A Troop. They also destroyed elements of the Medina Republican Guards Division and an Iraqi theater-level logistics site.[3] In Operation Desert Storm, attack helicopter operations throughout the close, deep, and rear framework of the battlefield were commonplace.[4]

Over the past thirty years, the attack helicopter has matured as an integral part of combined arms warfare in the United States Army. It has improved from 'gunship' to 'advanced attack helicopter.' Its role has expanded from aerial fire support to aerial maneuver.[5] Attack helicopter units have spread from airmobile and infantry divisions to every division in the army.[6] In addition, these organizations have grown from 'aerial

weapons' companies to attack helicopter battalions (ATKHBs). Both the attack helicopter and its organizations have evolved to meet the changing environment of the battlefield.

The Present . . . .

Today, the ATKHB is the heavy division commander's primary aerial maneuver asset. It provides him a unique means for extending and dominating his battle space well beyond the limits of ground maneuver forces. During Operation Desert Storm, ATKHBs were so effective that one division commander claimed them to be ". . . the single biggest maneuver factor on the battlefield . . . ."[7] While this may be a bit of an overstatement, they certainly proved to be invaluable members of the combined arms team. The Gulf War put the stamp of success on three decades of attack helicopter evolution in the U.S. Army.

Even as Operation Desert Storm was taking place, forces were in motion that were rapidly changing the environment that had shaped the development of the attack helicopter. The Cold War focus on the Warsaw Pact armies was swept away by a wave of geo-strategic change. In the wake of this change, a new array of potential threats and an expanding spectrum of military operations are emerging to challenge the U.S. Army. In addition, a rising tide of technological development is reshaping military forces world-wide. Relatively inexpensive, readily available, high-technology equipment is transforming many militaries into increasingly dangerous organizations. The new security environment being created by these (and other) forces promises to be a volatile and uncertain one, characterized by widely varied threats, forces, and operations. To remain successful, the Army will have to anticipate and adapt to it.

Army Aviation is already taking steps to meet the projected challenges of this newly emerging environment. It is beginning to reshape the heavy division ATKHB, as well as

other aviation units. The Aviation Restructure Initiative is already altering the composition and structure of the unit. Additionally, modernization programs will introduce new and advanced helicopters to the battalion over the next two decades. The AH-64D APACHE LONGBOW and the RAH-66 COMANCHE will take the ATKHB into the 21st century.

The Future. . . .

The conventional battlefield of the next century will place new demands on Army organizations. To be successful, units will have to be more lethal, agile, and survivable than they are today.[8] They will have to be capable of a high degree of precision and synchronization in their operations. As the Army enters the 'Information Age,' knowledge will become the decisive resource on the battlefield. General Gordon R. Sullivan, Chief of Staff of the Army, has stated that "in the world of the 21st century, the competitive advantage--the quantum competitive advantage--will derive from the quantity, quality, and usability of information."[9] Units must become capable of exploiting the power of information so they can provide the commander with effective tools with which to dominate his battle space. The ATKHB must become such an asset for the heavy division.

The Aviation Restructure Initiative, the AH-64D APACHE LONGBOW, and the RAH-66 COMANCHE hold the promise of preparing the ATKHB for the 21st century battlefield. Fiscal considerations, however, already threaten to cut short the transformation of the battalion by curtailing the COMANCHE program. This study seeks to assess the impact of the proposed restructuring and modernization. It will also assess the implications for the ATKHB on the 21st century battlefield should the Army fail to fulfill the entire scheme of change.

II. Background

A. The Heavy Division Attack Helicopter Battalion

The heavy division ATKHB was a product of the Army of Excellence (AOE) force restructuring of the mid-1980s.[10] The addition of four new divisions to the active Army caused force designers to stretch aviation resources, making the attack helicopter organizations extremely austere.[11] Since its fielding, the ATKHB in the heavy division has undergone significant changes. First, an aviation unit maintenance (AVUM) company was formed from the AVUM platoon assets in the headquarters and service company. Second, the AH-64A APACHE helicopter replaced the AH-1 COBRA. Figure 1 traces the evolution of the ATKHB from 1985 to the present.[12]

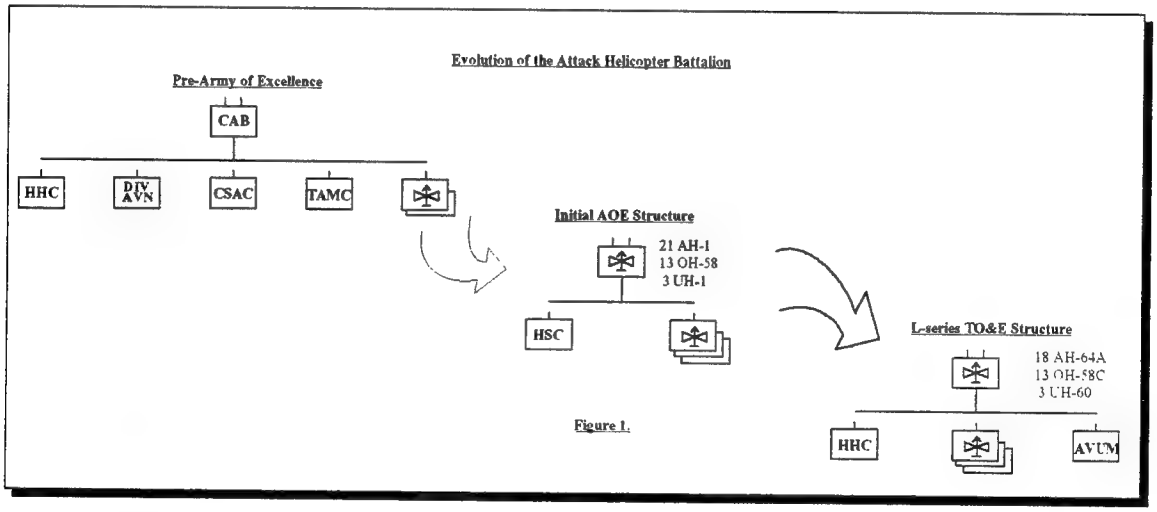


Figure 1.

The ATKHB is currently organized under the L-series table of organization and equipment (TOE). It has a headquarters and headquarters company (HHC), three attack helicopter companies, and an AVUM company. It is equipped with 18 AH-64A APACHE attack helicopters, 13 OH-58C KIOWA scout helicopters, and 3 UH-60 BLACKHAWK utility helicopters.[13] The base TOE manning for the battalion is 265 personnel.[14]

B. Aviation Restructure Initiative

The first changes to affect the current attack helicopter battalion will be those associated with the Aviation Restructure Initiative (ARI). Approved by the Chief of Staff of the Army on 3 February 1993, the ARI is a branch-wide force restructuring program.[15] It attempts to correct the deficiencies of the austere AOE aviation force structure and to integrate modernized aircraft into units. It is also attempts to reduce logistic requirements, drive down fleet operating costs, and retire older aircraft.[16] The objective of the initiative is to shape the aviation force structure for the beginning of the 21st century.[17]

The program proceeds through several stages. First, the ARI restructures the ATKHB into an interim organization based exclusively on the AH-64A APACHE. Then, while in this interim configuration, the battalion incorporates the AH-64D APACHE and the LONGBOW system.[18] Finally, the ARI transitions the battalion to a final objective structure incorporating the RAH-66 COMANCHE helicopter.[19] Figure 2 illustrates the ARI restructuring.[20]

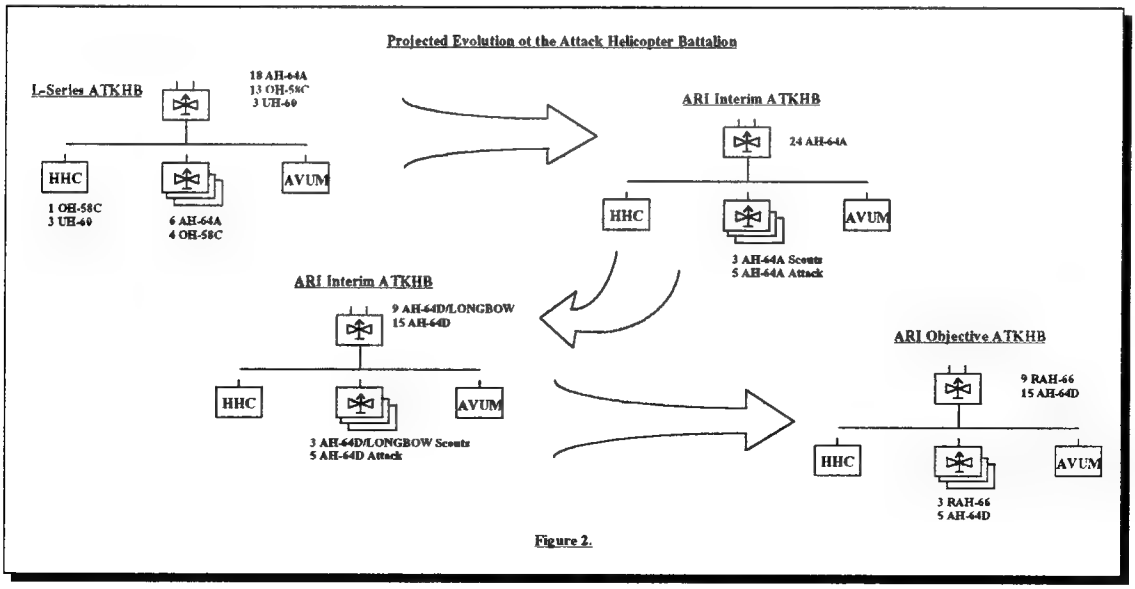


Figure 2.

C. Aviation Modernization

Army Aviation has several aircraft modernization programs closely associated with the ARI and the ATKHB. These programs include upgrades of existing aircraft, major modifications of existing aircraft, and the introduction of new systems and aircraft. They represent near-term, mid-term, and long-term increases in aircraft capabilities.

In the near term, the AH-64A fleet will receive upgrades that will convert its airframes into AH-64A(+)s. The conversion provides near-term 'fixes' for aircraft deficiencies underscored by Operation Desert Storm. It includes improvements to the aircraft's pilotage, navigation, communications, and weapon systems.[21]

In the mid-term, the entire APACHE fleet will be converted into AH-64Ds in conjunction with the fielding of the LONGBOW system. The aircraft will receive extensive modifications, including structural, ergonomic, pilotage, navigational, communication, and weapon system changes. Each aircraft will be compatible with the LONGBOW system. The LONGBOW system represents a major modification of the APACHE's target acquisition system and HELLFIRE weapon system. It promises to greatly enhance the combat power potential of the AH-64.[22]

The RAH-66 COMANCHE armed reconnaissance helicopter will complete the modernization of the ATKHB. It will assume the aeroscout role and replace those AH-64s used as scouts in the interim ARI structures.[23] The COMANCHE will incorporate several new and emerging technologies to enhance its maneuver, firepower, and protection capabilities.

D. Requirements of 21st Century Warfare

In their book, War and Anti-War, Alvin and Heidi Toffler present a vision of 21st century warfare, one that has had a profound impact upon the Army. They see a new warfare form emerging as the world approaches the turn of the century, one born of the increasing proliferation of advanced information technologies. Termed "Third Wave warfare,"[24] knowledge is its "central resource of destructivity."[25] It is characterized by selective, precision destruction, with minimal collateral damage and minimal waste of material resources.[26] In contrast, the Tofflers see the current dominant warfare form ("Second Wave"[27]) as characterized by mass destruction, effective, but wasteful in terms of collateral damage and expenditure of resources.[28] They believe that Third Wave warfare will become the dominant form in the next century.

In Training and Doctrine Command (TRADOC) Pamphlet 525-5, Force XXI Operations, the Army embraces many of the Tofflers' concepts. The pamphlet acknowledges the power that information is likely to have on the future battlefield, predicting a "thousandfold advance" in information technology in the next two decades.[29] It envisions units building and maintaining a real-time, shared situational awareness of the battlefield which will dramatically increase their combat power.

Force XXI Operations predicts a conventional battlefield which will pose new challenges to the application of combat power. The early 21st century battlefield is likely to be much larger than today, continuing the evolutionary trend toward the 'empty battlefield.'[30] Units will operate in a more distributed manner, increasing the dispersion of individual systems and giving the battlefield a non-linear, even non-contiguous, aspect. This will make the enemy harder to find and destroy. The likelihood of an ever-present

news media also presents challenges. Commanders must assume that their operations will be closely scrutinized by the public. They will have to tailor their operations to achieve battlefield success and prevent negative impact on national will. Additionally, current fiscal trends suggest that the Army will have fewer resources to employ on the battlefield. Commanders will have to employ their assets to achieve success while avoiding undue waste of resources.

All these factors lead to a requirement for great precision and synchronization of operations. Finding and destroying the enemy on the expanded battlefield will require precise targeting, positioning, and delivery of munitions. Decisive operations in this environment will require that the enemy be struck throughout the depths of his battle space in order to overwhelm him. Such operations will require a high degree of synchronization between all arms to be successful. Media presence will increase the need to reduce collateral damage to avoid possible negative effects on popular will. This further reinforces the need for precision and synchronization in all operations. Additionally, precision and synchronization of operations promise to preserve limited resources. For example, achieving a 'one shot, one kill' capability will preserve scarce ammunition resources. Units on the 21st century battlefield must not only have greater combat power, they must have the ability to apply it in a precise, synchronized manner.

E. Methodology

There are many ways to evaluate the impact that restructuring and modernization will have on the ATKHB. This study will use the dynamics of combat power as a framework to analyze the impact of these programs. It will group the changes brought about by restructuring and modernization into three phases. The first phase includes the initial ARI

restructure to the interim battalion and the upgrade of the APACHE to the AH-64A(+). The second phase encompasses the incorporation of the AH-64D and the LONGBOW system into the battalion. The third phase includes the incorporation of the RAH-66 into the ARI final objective structure. The study will assess the effects of the changes of each phase on the combat potential of the battalion to determine if it is becoming more lethal, agile, and survivable. It will also assess the implications of the process for preparing the ATKHB for the 21st century conventional battlefield. Finally, it will discuss the objective battalion's integration into the combat functions.

Field Manual 100-5, Operations, terms combat power as the ability to fight.[31] Combat power is generated by leaders translating maneuver, firepower, and protection potential into effective action.[32] In part, this potential is the result of equipment, manning, and organizational structure. This study will focus on these aspects as they relate to the firepower, maneuver, and protection elements of combat power, using a model developed by then Colonel Huba Wass de Czege.[33] Leadership, training, and other sources of combat potential are beyond the scope of this study.

This study will use the U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-5, Force XXI Operations, as a guide to the projected nature of 21st century warfare. It is TRADOC's vision of war and operations other than war in the early 21st century.[34] It predicts the conditions and requirements of future operations to which the ATKHB must adapt in order to remain an effective member of the combined arms team. In particular, this study will focus on the increase of the ATKHB's abilities to conduct precise, synchronized operations through the development of a shared, situational awareness of the battlefield.

III. Observations on the AOE Attack Helicopter Battalion

The current ATKHB is like a javelin on the conventional battlefield: lethal, far-reaching, but fragile. When employed, it can have a devastating effect on the enemy, but it can easily be shattered. While the battalion proved effective in Operation Desert Storm (its first combat test), the fighting confirmed some significant weaknesses. The major weakness of the organization is rooted in the inherent vulnerability of the helicopter. Several weaknesses are the legacy of the austere AOE aviation force structure. Other weaknesses arose because of the age and incompatibility of the battalion's scout and attack aircraft.

Even with advanced models like the AH-64A APACHE, the helicopter remains vulnerable to most weapons on the battlefield. Small arms are a significant threat, as are a wide array of more lethal weapon systems. The ATKHB must rely heavily on concealment and exposure limitation to survive on the battlefield.

The battalion lacks the capability to conduct continuous, high-tempo operations. The austere staff is not capable of sustained, 24-hour operations and planning.[35] Additionally, it lacks some of the key personnel it needs to synchronize supporting systems.[36] Maintenance positions are filled only to 69% of the Manpower Requirements Criteria,[37] stretching the battalion's maintenance capabilities thin. There is no depth to the numbers of ammunition and fuel handlers, limiting the battalion's ability to sustain forward arming and refuel point (FARP) operations for long periods.[38] The ATKHB's austere manning is a clear limitation to its combat potential.

Another weakness is the poor match of OH-58Cs and AH-64As in their respective aeroscout and attack helicopter roles (see Appendices A and B to compare

characteristics). Developed in the late-1960s, the OH-58C is quickly reaching obsolescence on the battlefield. It has no advanced systems to help it perform its aeroscout role. It must rely on pilot eyesight for target acquisition. It has no target handover or designation capabilities compatible with the APACHE's laser spot tracker (LST) or semi-active laser (SAL) guided HELLFIRE missiles (HFMs). The OH-58C also lacks compatibility with the AH-64A in terms of speed, night vision systems, self-deployment capability, and navigation systems. This lack of compatibility often degrades the effectiveness of the battalion by forcing the AH-64A into the aeroscout role at the expense of its attack role.

Unlike the aging KIOWA, the AH-64A is just reaching its prime as an attack helicopter. It performed effectively in ODS, which saw 45% of the APACHE fleet deployed to the Persian Gulf.[39] The AH-64A's armament proved lethal to any vehicle on the battlefield, and its night/adverse weather capability was considerable.[40] While Operation Desert Storm did not demonstrate the AH-64A's full potential, it did provide strong indications of its capability. It also revealed several deficiencies. The AH-64A had difficulty communicating beyond a short distance when operating at terrain flight altitudes. Battlefield obscurants significantly reduced the probability of hit of the HELLFIRE because of their effects on laser designators. Design flaws in the 30 mm weapon system caused reliability problems and forced excessive reload times. Finally, the AH-64A required a great deal of maintenance to retain operational readiness.[41]

IV. ARI Interim Battalion (AH-64A and A+)

A. Structure and Composition

The initial phase of the ARI produces the most sweeping changes to the manning and composition of the ATKHB. It reduces the battalion from three aircraft types to one. In addition, it modifies the structure of the HHC and AVUM and increases their manning levels.[42]

The most striking change is the conversion of the battalion to an AH-64 pure organization. The ARI transfers both the OH-58C and the UH-60 helicopters out of the unit, eliminating the KIOWAs and consolidating the BLACKHAWKs with the aviation brigade's other utility helicopters in the General Support Aviation Battalion (GSAB).[43] To replace the scouts, the battalion receives six additional AH-64As.

The ARI consolidates all 24 AH-64As in the attack helicopter companies. Each attack company will have eight AH-64As. Three of these will belong to the aeroscout platoon and five to the attack helicopter platoon.[44] For planning, the attack helicopter company will operate with two AH-64As configured as scouts and four configured for attack with the remaining two in maintenance.[45] Figure 3 illustrates the AH-64A scout and attack configurations.[46]

AH-64A: Scout and Attack Configurations

Normal Attack	Anti-armor Attack	Scout
		
8 Hellfire Missiles 38 Rockets 1200 30mm	16 Hellfire Missiles 1200 30mm	8/4 Hellfire Missiles 19/38 Rockets 1200 30mm 1 auxiliary fuel tank

Figure 3

This initial interim battalion also incorporates the AH-64A(+) aircraft modernization upgrades (see Appendix C). The intent of the A(+) upgrades is to correct several deficiencies highlighted by Operation Desert Storm. The upgrade program will install an Embedded Global Positioning System/Inertial Navigation System (EGI) for improved navigation.[47] It adds a high frequency radio with a 300 kilometer, non-line-of-sight, secure communications capability. This radio begins the 'digitization' of the APACHE by enabling the digital transmission of formatted and free text messages.[48] The A(+) program also repositions other radio antennas for improved range and converts the aircraft radio suite to SINCGARS radios. In addition, the A(+) upgrades improve the 30 mm cannon, the identification friend or foe (IFF) system, the Fire Control Computer, and the Target Acquisition and Designation and Pilot Night Vision Systems (TADS/PNVS). The entire AH-64A fleet will receive these modifications.[49]

B. Combat Power Analysis

This phase of change affects each dynamic of combat power. It improves the firepower, maneuver, and protection capabilities of the battalion. The following analysis evaluates the impact of these changes in each area.

Firepower

Converting to an AH-64A pure organization provides only a slight increase in firepower potential. The battalion's volume of fire capability shows only limited improvement, while its accuracy of fires and lethality of munitions show almost no change. The change improves the target acquisition capability of the aeroscout dramatically, but since the AH-64As of the AOE battalion often augmented the scouts, the improvement for

the battalion is moderate. The unit also gains greater flexibility in employing its fires, which adds to its firepower potential somewhat.

On the surface, exchanging 13 OH-58Cs (armed only with air-to-air Stingers) with 6 AH-64As appears to provide a considerable increase in the battalion's volume of fire capability. These aircraft could bring a maximum of 96 additional HFMs to the fight. It is unlikely, however, that the battalion will ever realize such an increase because these APACHEs will assume the aeroscout role. The primary duties of the aeroscout are to 'see the battlefield' and to secure the attack helicopters, not to engage targets. Figure 4 compares the representative armament loads of the AOE and ARI interim battalions for various mission profiles.[50] It shows that the battalion is likely to realize only a small increase in its actual volume of fire in an engagement. Additionally, battalion's Forward Arming and Refuel Point (FARP) and maintenance capabilities will tend to limit any significant increase in the battalion's volume of fire over the long term.[51]

Volume of Fire Comparisons: AOE vs ARI

Mission Profile	Aircraft Mix	Attack Weapons Configuration	Scout Weapons Configuration	Totals HFM	Totals Rockets
Normal					
AOE	9 OH-58C 15 AH-64A	8 HFMs 38 Rockets	None	120	570
ARI	6 AH-64A Scouts 12 AH-64A Attack	8 HFMs 38 Rockets	4 HFMs 38 Rockets	120	684
			Difference	0	114
Deep Attack					
AOE	0 OH-58C 15 AH-64A	8 HFMs 19 Rockets	None	120	285
ARI	6 AH-64A Scouts 12 AH-64A Attack	8 HFMs 19 Rockets	4 HFMs 38 Rockets	120	456
			Difference	0	171
Anti-armor					
AOE	13 OH-58C 15 AH-64A	16 HFMs 0 Rockets	None	240	0
ARI	6 AH-64A Scouts 12 AH-64A Attack	16 HFMs 0 Rockets	8 HFMs 19 Rockets	240	114
			Difference	0	114
Hvy Team/Lt Team					
AOE	13 OH-58C 9/6 AH-64A	16/8 HFMs 0/38 Rockets	None	192	228
ARI	6 AH-64A Scouts 12 AH 64A Attack	16/8 HFMs 0/38 Rockets	8/4 HFMs 19/38 Rockets	180	399
			Difference	(12)	171

Figure 4

Although replacing OH-58Cs with AH-64As in the aeroscout role does not necessarily improve the battalion's volume of fire capability, it does improve its target acquisition capability. The APACHE's Target Acquisition and Designation System (TADS) provides acquisition capability in three spectrums: visual, near infrared, and infrared. The Forward Looking Infrared (FLIR) system provides the AH-64A an effective limited visibility acquisition capability, which the KIOWA lacked. The major limitation of

the system is that it does not provide the resolution needed for target identification at extended ranges. This reduces the precision of the ATKHB's attacks and limits its ability to operate in close proximity to friendly ground forces in limited visibility. Figure 5 illustrates the improved target acquisition capability of the AH-64A scout over the OH-58C.[52] With its sensors, the AH-64A will be able to detect more targets, detect them earlier, and detect them at longer ranges than the OH-58C. The TADS also incorporates a laser rangefinder/designator (LRF/D) which the AH-64A scout can use to enhance target handover or to remote-designate for attack helicopters. The AH-64A(+) complements these capabilities by adding improved means of receiving intelligence and transmitting target data. Its improved suite of radios provides significantly greater range and reliability of communications, allowing continuous updates of intelligence and spot reporting even on long-range attacks.

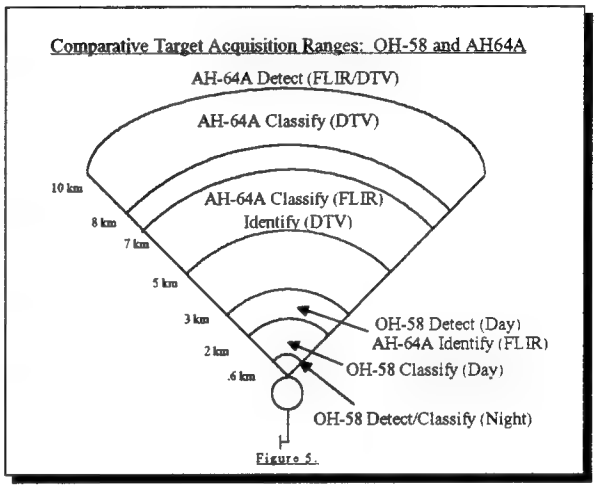


Figure 5.

The replacement of the OH-58C by the AH-64A gives the battalion greater flexibility in employing its fires. The extra AH-64As give the battalion an added capability to surge attack helicopters (or aeroscouts) when necessary. Armed scouts give the battalion a greater capability to capitalize on targets of opportunity. They enable the battalion to bring a wider array of munitions combinations to the fight. The full compatibility between AH-64A aeroscout and attack helicopters (in terms of speed, navigation, and night vision systems) provides the battalion greater flexibility in extended range and limited visibility

operations. The ability of the AH-64A scout to remote-designate for the attack helicopter's missiles also gives the battalion a wider range of engagement options. All these factors combined, however, will only provide a slight increase in the firepower potential of the battalion.

Maneuver

This phase of change improves the maneuver potential of the battalion in two ways. First, the conversion to an AH-64A pure organization enhances the unit's aerial mobility by standardizing the capabilities and tempo of both the scout and attack helicopters. Second, the AH-64A(+) upgrade improves the command, control, and communications (C3) capability of the battalion. Both moderately improve the battalion's potential for gaining positional advantage on the battlefield.

The replacement of the OH-58C by the AH-64A improves the interim battalion's aerial mobility capability by eliminating the speed, range, navigational, and night vision system differential between the battalion's aircraft. The entire unit can move faster, farther, with greater accuracy, and without the danger of mixing non-compatible pilotage systems in limited visibility conditions. The improved precision navigation capability provided by the EGI on the AH-64A(+) will further enhance the battalion's mobility, especially for long-range, limited visibility operations.

While the replacement of the OH-58C by the AH-64A provides immediate gains in unit mobility, it initially degrades the battalion's C3 capabilities. The APACHE has fewer radios than the KIOWA, and they are less reliable. This will complicate command and control of the unit, especially on long-range missions. The A(+) upgrade, however, will alleviate this problem. It actually provides the battalion a dramatically better

communications capability than it had previously. The elimination of the OH-58Cs means a loss of a command and control enhancement capability. They are currently used extensively for liaison and courier work by the battalion. It is impossible to judge what the overall impact of this loss will be, but it should be minor.

Protection

Perhaps the greatest gain for the ATKHB in this phase is in protection potential. While there are some trade-offs in exchanging OH-58Cs for AH-64As, the APACHE is significantly better in a reconnaissance role than the KIOWA. Acting as an aeroscout, the AH-64A can provide better force protection for the battalion.

Effective reconnaissance and counterreconnaissance are critical to force protection.[53] In most cases, the AH-64A's sensors enable it to be a much more effective reconnaissance platform than the OH-58C. While its larger signature makes it easier to detect during the day, the range of its TADS sensors give it a better capability of maintaining standoff from threat systems. The APACHE is also better equipped to fly in limited visibility conditions, which it can exploit to offset its larger signature. Since attack helicopter doctrine espouses night operations,[54] this is of great benefit to the battalion. Additionally, the AH-64A's weapon systems give it a counterreconnaissance capability that the KIOWA lacked. Not only can it engage threat reconnaissance elements directly, but the APACHE can also send target data (with eight-digit accuracy) to other attack systems so they can destroy the threat element. Through both reconnaissance and counterreconnaissance operations, the AH-64A aeroscout will better enable the battalion to limit the exposure of the attack helicopters, which is vital to the survival of the aircraft.

Overall

The conversion of the ATKHB to an AH-64A pure organization provides only a moderate increase in combat potential over the AOE case. Since the AOE battalion already had eighteen AH-64As, the addition of six more does not add new capabilities. Instead, it corrects deficiencies of less capable helicopters and adds greater depth to capabilities the battalion already possessed. As a result, firepower potential increases only slightly, with maneuver and protection making moderate gains.

The Training and Doctrine Command Analysis Center's Attack Helicopter Battalion Study supports this assessment. It indicates that the battalion's lethality (a product of firepower and maneuver) does not increase significantly per single engagement.[55] The study also indicates that survivability (a product of protection, firepower, and maneuver) increases significantly.[56] This increased survivability will translate into increased lethality in the long run, because the battalion will have more aircraft to return to the fight. The battalion's agility (a product of mobility and situational awareness) increases slightly, primarily because of the elimination of less mobile helicopters. Overall, the AH-64A pure battalion promises to be moderately more effective than the AOE battalion.

Even with increased combat potential, the ARI interim ATKHB is still prepared more for the 20th than the 21st century. The changes improve the battalion's 'mass destruction' capabilities, rather than its 'precision destruction' capabilities. Firepower and security improve by increasing the quantity of sensors and weapon systems available, not their quality. Maneuver improves primarily through standardizing physical capabilities, not through better knowledge of the battlefield situation. The AH-64A(+) upgrade, however, does show the first, rudimentary steps toward leveraging information to increase combat

effectiveness. The increased range and data transfer capabilities of the AH-64A(+) begin to establish a capability for digital connectivity on the twenty-first century battlefield. It falls well short, however, of enabling the battalion to build and maintain a shared, situational awareness of the battlefield.

V. ARI Interim Battalion (AH-64D)

A. Structure and Composition

The second phase of change integrates the AH-64D and the LONGBOW system into the unit. The battalion exchanges all of its AH-64A(+)s for the more advanced AH-64D APACHEs and receives a projected nine LONGBOW systems. Each attack helicopter company will probably receive three of these systems for operations.[57] It is likely that the aeroscouts will primarily use the LONGBOW system.[58] Other changes to the battalion associated with the integration of these systems are negligible.

B. System Description: AH-64D (see Appendix D)

The AH-64D is an extensively remanufactured version of the basic APACHE helicopter. It retains the pilotage, target acquisition, and weapon systems of the AH-64A and the system upgrades of the A(+). In addition, it adds:

-An ergonomically designed Manpower Personnel Integration (MANPRINT) cockpit to improve crew efficiency and reduce workload.

-A tri-service Improved Data Modem (IDM) to provide a digital data transfer capability.

-A laser ring gyro Inertial Navigation Unit with integrated GPS for improved precision navigation.

-An air-to-air missile capability.

-A Mission Planning Console with a Data Transfer Module (DTM) for loading, recording, and downloading mission data.[59]

It also includes a number of reliability improvements to improve and ruggedize aircraft systems. As part of their modifications, all AH-64Ds will be made compatible with the LONGBOW system.[60]

The MANPRINT cockpit, the IDM, and the Mission Planning Console promise to greatly enhance the AH-64D as a fighting platform. The MANPRINT cockpit modification replaces most of the gauges, switches, and control panels with two multi-function displays (MFDs) per crew station. One use of the MFDs will be to show mission graphics and targets in a tactical situation display (TSD). The Mission Planning Console enables the crewmembers to upload graphics through the DTM or to create them in flight, as needed. The DTM also stores target files and 'shot at' files of targets acquired and engaged, respectively. The IDM enables digital transfer of mission data to other AH-64Ds, and to any other station equipped with a tri-service IDM, using the aircraft's radios. These systems will enable the battalion to begin to build and maintain a real-time, shared, situational awareness of the battlefield. [61]

C. System Description: LONGBOW

The LONGBOW system is an integrated target acquisition and weapon system which will provide a quantum leap in APACHE capabilities. It is designed to be employed on any AH-64D. Its major components are:

-A mast-mounted Fire Control Radar (FCR).

-A Radar Frequency Interferometer (RFI).

-Radar Frequency (RF) HELLFIRE missiles.

When mounted on the AH-64D, the LONGBOW system is integrated into the aircraft's other target acquisition and weapon systems.[62]

The FCR provides automatic target detection, classification, and prioritization. It is a millimeter wave, coherent doppler radar system capable of detecting both air and ground targets. It can detect up to 1028 targets, display up to 256, classify them, and prioritize the top 16. The FCR's target identification routines enable it to classify targets as tracked, wheeled, air defense, rotary-wing, fixed-wing, or other. It does not, however, provide target recognition or identification. When required, the aircrew must use the TADS to identify targets (see Figure 6[63]). The FCR prioritizes targets based on engagement schemes pre-selected by the aircrew and automatically readies the RF missiles for engagement. The FCR can also cue the aircraft's other weapons and sensors to the targets. The crew can pass FCR target data to other AH-64s through its Enhanced Airborne Target Handover System (EATHS). In addition to its target acquisition capabilities, the FCR also provides a terrain profiling capability to aid in pilotage and navigation.[64]

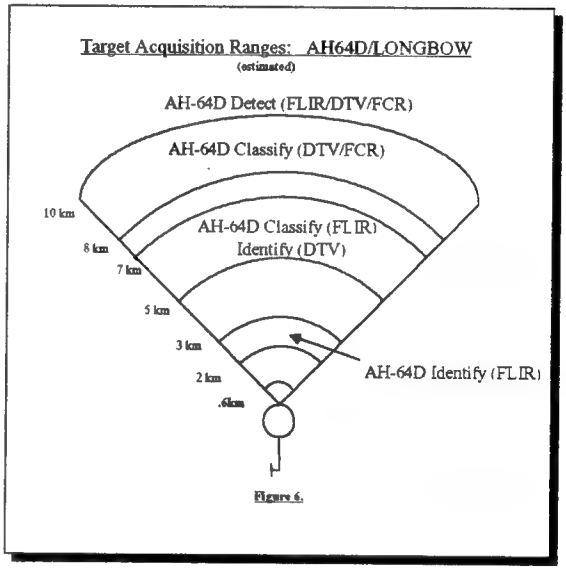


Figure 6.

The RFI automatically detects, classifies, and direction-finds to radar emitters. It is omni-directional and can cue the FCR or other acquisition systems to the emitter. The RFI is designed primarily to help counter threat radar directed air defense systems.

Working through the FCR, it provides the AH-64D with a significant capability to conduct complementary suppression of enemy air defense (SEAD).[65]

The RF missile completes the LONGBOW system. It is a variant of the basic HFM, but it incorporates an active millimeter wave radar guidance system rather than the semi-active laser (SAL) seeker. The millimeter wave guidance system provides the missile a fire-and-forget capability. It also improves the missile's performance in adverse weather and against battlefield obscurants. In addition, the RF HELLFIRE provides a limited non-line-of-sight engagement capability. Once the FCR has acquired the targets, the aircrew can launch the RF HELLFIRE from a masked position. The RF missile will home to the target area and use its millimeter wave radar seeker for terminal guidance to the target. The RF missile is designed to be lethal against foreseeable 21st century armored vehicles.[66]

D. Combat Power Analysis

Firepower

The AH-64D and the LONGBOW system will bring a dramatic increase to the battalion's firepower potential. They will enable the battalion to increase its volume and accuracy of fires, vastly improve its target acquisition capabilities, and enhance its flexibility in employing its weapon systems. The only aspect of firepower potential that does not increase significantly is lethality of munitions, which remains the same.

The LONGBOW system enables the battalion to increase its volume of fire by increasing its rate of fire capability. The automated target acquisition systems and the fire-and-forget capability of the RF missile reduce engagement times to seconds. An

AH-64D, equipped with RF missiles and supplied with target data from an FCR (onboard or through EATHS) will be able to engage as many as sixteen separate targets in a minute. In comparison, an AH-64A would only be able to engage one or two targets in the same time frame.[67]

A major limiting factor on volume of fire will be ammunition supply. While the AH-64Ds will be able to expend HFMs up to eight times as quickly as the AH-64A in a single engagement, they don't carry any additional missiles. Once expended, the AH-64Ds must return to the FARPs, which won't be able to rearm them any quicker than AH-64As. The FARPs become a bottleneck, limiting the speed with which the AH-64Ds can return to the fight. Compounding the problem is the need to stock and manage both RF and SAL missiles. In continuous operations, the result is that the AH-64D and LONGBOW equipped battalion will be limited to a similar volume of fire as that of the AH-64A equipped battalion.[68]

The millimeter wave radar of the LONGBOW system helps the battalion achieve a greater accuracy of fires by overcoming a wider range of battlefield obscurants than the AH-64A. The accuracy of the SAL missile is often degraded by dust, smoke, fog, and other obscurants.[69] The millimeter wave radar of the FCR and the RF missile, however, is capable of penetrating atmospheric obscurants up to heavy rain or snow.[70] This will increase the probability of hit of each missile.

Both the AH-64D and the LONGBOW provide the battalion with capabilities that improve target acquisition. First, through the power of the 'IDM net,' the AH-64D will be able to receive real-time intelligence and automatically integrate it with onboard mission data.[71] This will help ensure that the battalion does not miss the target if it deviates from

the projected engagement area. Second, the LONGBOW's millimeter wave radar adds a fourth spectrum to the APACHE's target sensors, increasing the probability of detecting the enemy over a wider spectrum of battlefield environments. Finally, LONGBOW's automated detection, classification, and prioritization routines speed up target acquisition well beyond human capabilities. For example, the LONGBOW can search a 28 square kilometer area in less than a minute and be ready to engage any targets detected.[72] It is this capability that allows exploitation of the increased rate of fire potential. The major limitation to the LONGBOW is that it provides only target detection and classification. It does not provide target identification. All vehicles detected are classified and displayed as icons on the TSD, with no indication of friendly or enemy status (or of condition). In situations where specific systems must be destroyed or when friend or foe identification is critical, the aircrew must rely on the FLIR sensor. This will negate much of the advantage the LONGBOW provides in speed and range of detection.

The fusion of the AH-64D and the LONGBOW provides an unparalleled flexibility to the battalion. First, the enhanced situational awareness provided by the integration of intelligence, sensor, and mission data (continually updated in near real-time) will help the battalion to determine where its fires will have best effect. Through the Mission Planning Console, the commander can design and automate fire control and distribution measures based on this enhanced situational awareness. He can distribute his control measures to all his AH-64Ds through digital data burst transmission for display on the TSD. The FCR integrates into the process by automatically orienting RF missiles into the assigned sector of fire and prioritizing targets. The FCR will not allow RF missiles to violate designated restrictive fire measures unless overridden manually by the aircrew. This enables the

battalion to exploit its increased volume of fire potential while reducing fratricide risks.[73] The lack of precise target identification, however, will tend to limit the full realization of this flexibility.

Maneuver

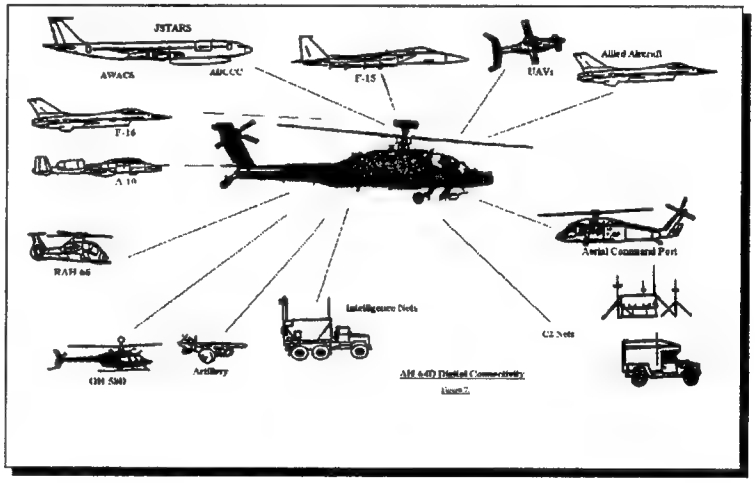
The AH-64D and the LONGBOW will also bring a considerable increase in the battalion's maneuver potential. Unit mobility remains the same as the AH-64A pure battalion, but the speed of the AH-64D's information management systems will enable greater agility. Coupled with the enhanced situational awareness provided by the integration of information collection, processing, and dissemination, this agility enables the battalion to better seize the positional advantage on the battlefield.

The fusion of mission data, intelligence data, and target acquisition data in the TSDs will provide both commanders and aircrews a greater ability to 'read the battlefield' during missions. They will have easy access to a wide array of information, displayed graphically, that will allow them to update continually their tactical analysis of the situation. In comparison, the AH-64A's reliance on paper maps, notes, and voice updates is clumsy and inefficient. The AH-64D's lack of a digital map does not allow full exploitation of the TSD's possibilities, but it still outstrips the AH-64A's capabilities. The speed with which the battalion can now process information will complement the mobility of the helicopter rather than hinder it. It greatly improves the agility of the battalion.

The 'digitization' of the AH-64D improves not just situational awareness; it enables the battalion to begin to establish a 'common relevant picture' of the battlefield. Using the Mission Planning Console and the DTM, the commander can ensure that the entire battalion has an identical set of mission data, to include graphics, situation templates,

frequencies, and call signs. The IDM provides the capability for continual updates, even in flight, while still maintaining every aircrew on a standardized set of data. This standardized data set is the first step toward building and maintaining a 'common, relevant picture' of the battlefield within the battalion. Graphic display of the data allows easier manipulation during operations, ensuring less accidental deviation from planned actions. With each aircrew and the staff working from the same view of the battlefield, the battalion will be better able to synchronize and orchestrate its maneuver.

The IDM and the EATHS provide the battalion the potential to expand its real-time, shared, situational awareness to other members of the combined arms team and within the joint arena.[74] Figure 7 shows some of the projected communications links that could be established.[75] Through this connectivity, the battalion can better integrate its maneuver with the maneuver and fires of other friendly units on the battlefield. This enables the battalion to maximize its effectiveness within the overall scheme of the battle.



Protection

In addition to firepower and maneuver, the AH-64D and the LONGBOW will provide a considerable increase in the protection potential of the battalion. Used together in the aeroscout role, they will provide a quantum leap in capabilities over the AH-64A. They

will enable greater force protection within the battalion. In addition, they can provide a greater fratricide avoidance capability, another key component of protection.[76]

In an aeroscout role, the AH-64D and LONGBOW will far outstrip the AH-64A in reconnaissance and counterreconnaissance capabilities. They bring better acquisition sensors to the fight, providing greater ranges and reliability of detection. Graphic display of this information allows the aeroscout to perform immediate, limited analysis to enable the rest of the battalion to avoid the threat or to limit exposure to it. Advanced communications enable the AH-64D aeroscout to tap into other intelligence sources[77] which can cue it to threat forces, enhancing its ability to detect them on the battlefield. The battalion will have a better chance of avoiding threat systems or limiting exposure to them with an AH-64D aeroscout equipped with the LONGBOW.

The LONGBOW will also provide a considerable counterreconnaissance capability. Not only will the aeroscout detect enemy reconnaissance threats earlier and with greater reliability, but the LONGBOW's automated functions will also provide the AH-64D the capability to engage threat systems quicker than the enemy can react. This also applies to threats other than reconnaissance. For example, the aircraft can detect and engage a 2S6 and deploy to cover before the air defense system can engage.[78] The speed with which the aeroscout will be able to suppress threats will greatly enhance the battalion's protection potential. As mentioned earlier, the LONGBOW's lack of precision in identification of threat systems will tend to limit these capabilities in many situations.

Another factor which enhances the protection potential of the ATKHB is the fire-and-forget capability of the RF missile and the AH-64D's air-to-air missile. The RF missile enables aircraft to reduce dramatically their exposure times while engaging. The

AH-64D gains an air defense capability with its air-to-air missile while the LONGBOW provides early detection of air targets. These capabilities provide the battalion with improved security , ensuring greater survival of both scouts and attack helicopters.

Equally important, the battalion enjoys enhanced capability to avoid fratricide. Both shared, situational awareness and precision operations are key to avoiding fratricide.[79] The AH-64D and LONGBOW provide the battalion an enhanced shared situational awareness through the quantities of information they can acquire, process, and disseminate. Coupled with the aircraft's automated fire control capabilities, this situational awareness can both help and hinder fratricide avoidance. If provided with accurate friendly locations, the AH-64D's automated restrictive fire measures can help reduce the chance of fratricide. Without precise locations, however, the speed and lack of discrimination in the LONGBOW's targeting can increase the risk of fratricide. In many cases, the need for fratricide avoidance may hobble the battalion's superior capabilities.

Overall

The conversion of the battalion to AH-64Ds and the addition of the LONGBOW system create dramatic increases in firepower, maneuver, and protection potential. Organizational analyses of the AH-64D and LONGBOW equipped ATKHB indicate a potential increase in lethality of up to 30 percent.[80] These studies also indicate a decrease in vulnerability by as much as 52 percent.[81] The fusion of LONGBOW and the AH-64D greatly increases the agility of the battalion by increasing its situational awareness. The AH-64D/LONGBOW equipped ATKHB promises a considerable increase in effectiveness over the AH-64A pure battalion.

What truly increases the combat potential of the ATKHB in this phase of change is 'information power.' In many ways, the AH-64D and the AH-64A are very similar. In one area, however, they differ greatly: information management. The AH-64D/LONGBOW combination speeds the collection and processing of critical battlefield information well beyond the human capabilities that the AH-64A relies on. It displays this information in formats that enable quicker and more thorough understanding. Finally, it can share this information quickly and efficiently with a wide array of users across the battle space. The AH-64D/LONGBOW not only gives the aircrew a greatly enhanced situational awareness, but it provides the battalion with the means to begin building a 'common relevant picture' of the battle space as well. In doing so, the AH-64D/LONGBOW propels the ATKHB across the threshold of information age warfare.

The battalion, however, just barely crosses the threshold. Even though it makes dramatic gains in combat potential, the AH-64D and LONGBOW equipped ATKHB is still better suited to the 20th century battlefield than to 21st century's. Its capabilities for 'massed destruction' increase tremendously, while its capabilities for 'precision, synchronized destruction' make only moderate gains. The quantity of firepower the battalion can generate takes a great leap, but its precision is only slightly better than that of the AOE battalion. The increased quantity of information the battalion can process enables better maneuver and increased protection, but the lack of quality and usability of the information will hobble the battalion on the future century battlefield. Overall, the AH-64D equipped ATKHB provides a great increase in combat potential for the 20th century battlefield, but only a moderate one for the 21st century battlefield.

VI. ARI Objective Battalion (RAH-66)

A. Structure and Composition

The final phase of change integrates the RAH-66 COMANCHE armed reconnaissance helicopter into the ATKHB. The battalion keeps 15 AH-64Ds and the LONGBOW systems, but nine COMANCHEs will replace the nine AH-64Ds assigned to the aeroscout platoons of the attack helicopter companies. Aeroscout pilots and crew chiefs will become RAH-66 qualified. Additionally, a portion of the AVUM maintenance personnel will change to support the RAH-66. Overall, the general structure of the battalion does not change.[82]

B. System Description: RAH-66 (see Appendix E)

The RAH-66 COMANCHE will be the first completely new helicopter introduced into the ATKHB. It is specifically designed to fill the aeroscout role in both attack helicopter and air cavalry units. The COMANCHE will also be fully capable of assuming an attack helicopter role, if needed.[83] The RAH-66 incorporates a number of leading edge and emerging technologies to provide it capabilities superior to any other U.S. helicopter. Its most significant features are its low signature, enhanced target acquisition systems, and advanced mission support systems. Other important features include its weapon systems and maintenance requirements.

The COMANCHE exploits stealth technology and design in its airframe to reduce its signature on the battlefield. Constructed of low observables, the RAH-66 scout configuration has a radar signature 663 times less than that of the AH-64A and several hundred times smaller than the OH-58D KIOWA WARRIOR.[84] Its thermal signature is

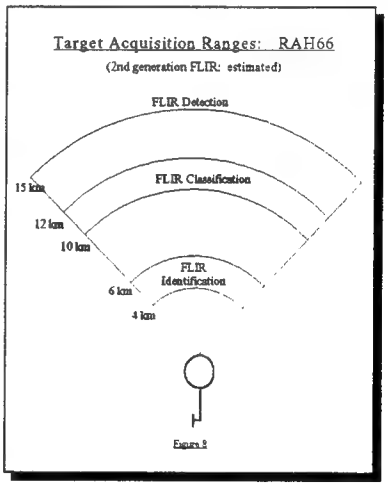
less than half of that of the APACHE and on par with the KIOWA WARRIOR.[85] This signature is so low that a STINGER missile cannot lock onto it.[86] Its visual signature approximates that of the AH-1 COBRA, and its acoustic signature is about that of an OH-58D.[87] These characteristics will greatly reduce the threat's ability to detect the RAH-66.

Even more important than its low observable design is the RAH-66's capability to acquire, process, and distribute information. The COMANCHE's Crew Support System (CCSS) integrates sensors, communications, and data management systems to provide the aircrew with a highly refined situational awareness. Like the AH-64D, the RAH-66 employs a tri-service IDM for digital data transfer to and from a wide array of stations. The COMANCHE will be able to tie into fire support systems through the Advanced Field Artillery Tactical Data System (AFATDS). It will be able to interface with intelligence systems through the Joint Tactical Information Distribution System (JTIDS) and will be able to link directly to airborne systems such as the EH-60 QUICKFIX and the RC-12 GUARDRAIL. The RAH-66 will also have joint interoperability, being able to interface with Air Force systems such as the Airborne Warning and Control System (AWACS), the Joint Surveillance Target Attack Radar Systems (JSTARS), and close air support aircraft.[88] It can constantly update both intelligence and mission data, even in flight.

It fuses this information, as well as target data from its sensors, with digital, color maps that can provide the aircrew with a three-dimensional perspective of the battlefield. By relating enemy and friendly forces to the terrain, the CCSS provides a significant increase in shared, situational awareness. The COMANCHE also includes a single-frame video transfer capability and automated reporting in its data management capabilities.[89] The

video transfer capability enables the RAH-66 to transmit real-time 'snap shots' of the battlefield directly to other components of the combined arms team. The automated reports reduce critical data transfer to as little as three seconds.[90] The battalion can exploit these capabilities to build a common, relevant picture of the battlefield that is unrivaled by that of the AH-64D battalion. The COMANCHE's information management capabilities led Major General John D. Robinson, while head of the Aviation branch, to envision it as ". . . the quarterback of the digital battlefield."[91]

The COMANCHE employs a suite of target acquisition sensors much like that of the AH-64D, however, its FLIR sensor is vastly improved. The COMANCHE employs a second-generation FLIR system that provides up to 53% greater detection range, 93% greater classification range, and 107% greater identification range than the AH-64D's system. Figure 8 illustrates RAH-66's target acquistion capabilities. The RAH-66 integrates automated target detection and classification routines with the FLIR system to speed the target acquisition process.[92] Unlike the LONGBOW system, the COMANCHE's FLIR displays actual target images instead of icons, greatly enhancing target recognition and identification. The COMANCHE is fully compatible with the LONGBOW system and can add the FCR and RFI to its suite of sensors.



Although designed as an aeroscout, the RAH-66's weapon systems are as formidable as those of the AH-64D. It can carry a mixture of HELLFIREs, rockets, and air-to-air missiles in its internal bays and external weapon rails. The COMANCHE employs a 20mm

VULCAN II gatling gun, which (unlike the APACHE's 30 mm cannon) is an effective air-to-air weapon.[93]

The COMANCHE promises a significantly lower maintenance requirement than any other U.S. Army helicopter. Its specifications call for 2.6 maintenance man-hours per flight hour,[94] compared the AH-64A's 15. If the specifications can be achieved, the fielding of the RAH-66 will cause a drastic reduction in the battalion's maintenance workload. Even a worst case of 9 maintenance man-hours per flight hour[95] would be a significant improvement. This will enable the battalion to maintain substantially higher readiness rates for its aircraft.

C. Combat Power Analysis

Firepower

The RAH-66 does not appear to affect significantly the ATKHB's volume or accuracy of fire or its munitions lethality. It does improve, however, the precision of the battalion's target acquisition and its flexibility in employing fires. These improved abilities will greatly increase the battalion's firepower potential on the 21st century battlefield.

As an aeroscout, the COMANCHE improves the ATKHB's target acquisition capabilities with its low observables and advanced information systems and sensors. With the refined situational awareness provided by the CCSS, the RAH-66 will have a better capability to orient the battalion on an enemy force prior to actual contact. After positioning itself for best observation of the threat, the COMANCHE will be able to detect and classify targets at a range several kilometers further than that of the AH-64D. The greater resolution of the second-generation FLIR also enables reliable identification of

targets at greater distances. This will enable the battalion selectively to engage high payoff systems at standoff ranges and to reduce significantly the loss of opportunity from fear of fratricide. The RAH-66's low observable design enables it to conduct reconnaissance aggressively with little fear of detection, even in terrain that does not allow acquisition at maximum standoff ranges. Once the COMANCHE acquires targets, the CCSS enables it to hand them over efficiently to the attack helicopter or to any of a wide array of potential supporting systems.

The refined situational awareness made possible by the RAH-66 will provide the battalion greater flexibility in employing its fires. The COMANCHE will enable the battalion to select the most appropriate weapon system to engage each target and to destroy them in priority. The COMANCHE's longer target acquisition ranges, automated information functions, and digital communications will provide the battalion more time to orchestrate its organic and supporting fires to best effect. The result will be tailored, precision destruction of the enemy.

Maneuver

The RAH-66 will be slightly faster and have better flight performance than the AH-64D. This will not substantially increase the maneuver potential of the battalion, because the COMANCHE will only make up three-eighths of the ATKHB. The RAH-66's capabilities to collect, process, and disseminate battlefield information and to receive and integrate intelligence and mission data continually will provide a significant increase in maneuver potential.

With its helicopters, the battalion is already highly mobile. Coupled with the quality and usability of the quantities of information that the RAH-66 can process in near

real-time, the battalion can translate this mobility into an agility unmatched on the battlefield. With the refined situational awareness provided by the COMANCHE, the battalion can exploit this agility to gain positional advantage readily on the battlefield.

Protection

Protection is the element of combat power most enhanced by the integration of the RAH-66 into the ATKHB. Designed for reconnaissance, the COMANCHE will greatly increase force protection for the battalion. With its advanced sensors and information management capabilities, the RAH-66 will also reduce the risk of fratricide. These factors will provide a dramatic increase in the battalion's protection potential.

Field Manual 100-5, Operations, states that reconnaissance and counterreconnaissance are vital components of force protection.[96] The COMANCHE's low signature, advanced information management systems, and enhanced target acquisition systems will give it unparalleled reconnaissance and counterreconnaissance abilities. The RAH-66's reduced visual, acoustic, thermal, and radar signatures will enable it to avoid detection, while employing it acquisition sensors to produce a wealth of battlefield information. With its weapons systems, the COMANCHE can also fight for information or strip away threat reconnaissance systems with precision, standoff fires. Through the refined situational awareness it helps develop, the RAH-66 will enable the battalion to avoid threats when appropriate or to destroy them from standoff distances. As an aeroscout, the COMANCHE contributes immensely to the operational security of the battalion.

Like security, fratricide avoidance is a major component of protection.[97] Detailed situational awareness and disciplined operations are key to fratricide avoidance.[98] The RAH-66 provides the ATKHB with both capabilities. As discussed earlier, the CCSS

provides the aeroscout a highly refined situational awareness, with the second-generation FLIR enabling almost immediate target recognition within engagement ranges. The weapon systems of both RAH-66s and AH-64Ds enable precision engagement of selected systems once they are identified. This will enable the battalion to engage enemy forces effectively, even with friendly ground forces in close proximity, with a greatly reduced fear of fratricide.

Overall

The integration of the RAH-66 into the ATKHB has effects somewhat analogous to replacing the OH-58C with the AH-64A. It provides a tremendous increase in protection and significant (though smaller) increases in maneuver and firepower potential. The magnitude of the effects are far greater than the conversion to the AH-64A aeroscout, because the COMANCHE brings totally new capabilities to the ATKHB. More importantly, the incorporation of the RAH-66 finally provides the ATKHB the precision and synchronization it needs for the 21st century.

As with the integration of the AH-64D and LONGBOW, the ATKHB finds its lethality, survivability, and agility increased primarily through the power of information. While AH-64D/LONGBOW mainly increased the quantity of information available to the battalion, the RAH-66 balances quantity with quality and usability of the information to provide a refined shared, situational awareness of the battlefield. Although the COMANCHE has many important features, its information management capabilities are the ones that enable efficient exploitation of all the others. The RAH-66 lengthens the ATKHB's initial stride into the information age warfare environment and provides the unit a true 21st century capability.

VII. Integrating the Attack Helicopter Battalion Into the Combat Functions

The foregoing analysis shows that the combat potential of the ATKHB will change considerably by the time the unit reaches its objective configuration. Its capabilities for both 'Second' and 'Third Wave' warfare will increase tremendously. The battalion will be more lethal, agile, and survivable than it is today. It will be capable of selective, precision destruction on the battlefield. It will also possess significant capabilities to help the division as a whole develop the shared, situational awareness that many see as the key to 21st century warfare. Translating the ATKHB's combat potential into combat power relies on competent, imaginative leadership. The combat functions provide leaders a framework for building and sustaining combat power.[99] The following discussion presents a few general ideas on how the objective battalion can contribute to the combat functions for the heavy division. It focuses on the three areas where the battalion can make its greatest contribution: intelligence, maneuver, and fire support.

A. Intelligence.

The integration of the AH-64D, the LONGBOW system, and the RAH-66 will give the ATKHB a vastly improved reconnaissance capability. It will offer the division a highly mobile and responsive reconnaissance asset capable of covering wide or inaccessible areas and providing very detailed information. Through its advanced target acquisition and communication systems, the battalion will be able to process and transmit quickly the battlefield information it collects in near real-time. This will greatly enhance the division's

ability to maintain an accurate situational awareness and to produce a 'common, relevant picture' of the battlefield.

For a while, the ATKHB will be the most effective aerial reconnaissance asset in the division. After the fielding of the AH-64D and LONGBOW and before the introduction of the RAH-66, the battalion will have better reconnaissance capabilities than those of the OH-58D or AH-1 equipped air cavalry troops of the divisional cavalry squadron. This capability should not be taken lightly, especially considering the projected importance of information on the 21st century battlefield. The division will have to weigh carefully the costs and benefits of using the battalion in a reconnaissance role, but it is possible that the information the ATKHB can obtain will be more important than the destruction it could achieve.

B. Maneuver.

"Aviation maneuver--to place the enemy in a position of disadvantage through the flexible application of combat power in the third dimension."[100]

Aviation Warfighting Treatise, 1993

Throughout its changes, the attack helicopter battalion remains the heavy division's primary aviation maneuver asset. In this role, the attack helicopter battalion traditionally conducts attack and security operations.[101] While this will remain true for the battalion, its capabilities in each area increase significantly.

In the attack role, the objective ATKHB provides the division both a deep attack and a close fight asset. The improved range, speed, target acquisition, communication, and weapon systems of the battalion's aircraft make it a survivable, long-range, precision strike asset. The battalion will be able to move at speeds in excess of 250 kilometers per hour to

depths exceeding 300 kilometers (using one auxiliary fuel tank) and destroy over 100 enemy vehicles.[102] The battalion also has a 'stealth option,' using the RAH-66s together to infiltrate (rather than penetrate) through enemy defenses to attack selected high-priority targets.

As discussed earlier, the objective battalion will have a greater capability to work in close coordination with ground forces. Today, the synergy inherent in a multi-dimensional attack (aviation and ground) is negated by the risk of air-to-ground fratricide and the vulnerability of the aviation force to the concentration of weapons in the battle area. On the future battlefield, forces are likely to be less concentrated and more distributed. This will present more opportunities for employing the ATKHB with other ground forces in precision, synchronized attacks against dispersed units, capitalizing on the synergy of a multi-dimensional attack without incurring undue risk to either force..

C. Fire Support.

The ATKHB offers the division a focal point for tying together fire support assets with real-time battlefield situational awareness. Through the digital communication capabilities of its aircraft, the battalion will be able to coordinate the actions of a wide array of fire support assets to achieve decisive effects on the battlefield. The communication protocols of the IDM are compatible with those of the Army TACFIRE system and with the Air Force Advanced Protocol Development.[103] Through the IDM, the battalion can pass critical targeting data to both artillery and close air support aircraft with greater efficiency than ever before. In addition, the battalion will be able to tie in information from sources such as the EA-8B JSTARS to enhance fire coordination.[104] It will be able to enhance

greatly the effectiveness of joint air attack team operations as well as SEAD operations in support of the joint force.

VIII. Implications and Conclusions

The foregoing analysis indicates that the future heavy division ATKHB can become a highly lethal, extremely agile, and very survivable asset capable of effective operations on the future conventional battlefield. It assumes that Army Aviation will be able to carry out its proposed restructuring and modernization plans for the battalion. If it cannot, then the ATKHB will fail to fulfill its potential for 21st century warfare.

Current budgetary considerations already threaten the COMANCHE program. Even though it is the Army's top acquisition program,[105] planned production has already been reduced by half, and even more severe curtailments seem likely. Further reductions in military spending may endanger other programs, such as the AH-64D and the LONGBOW.

The implication of not fielding the COMANCHE is that the heavy division ATKHB will attain only a limited 'Third Wave' warfare capability. The implications for other units expecting to field the RAH-66, such as light division ATKHBs and air cavalry units, are likely to be more severe. Still equipped with AH-1s or OH-58D KIOWA WARRIORs, these units will have to rely on 1960's technology well beyond the turn of the century. Further study is needed to assess the full impact on these units.

Some would argue that the AH-64D and LONGBOW are sufficient for the future ATKHB. This would probably be true if 'Second Wave' warfare were likely to remain the dominant form. The AH-64D and LONGBOW bring impressive capabilities to the battalion, if evaluated from a 20th century conventional battlefield viewpoint. Viewed from a 21st century vantage point, however, these capabilities are not as impressive.

Additionally, the COMANCHE does not add greatly to the ATKHB's combat potential if viewed from a 20th century vantage point, but it increases the battalion's potential dramatically when viewed from a 21st century vantage point.

The conclusion is simple and clear. If the heavy division ATKHB is to remain a dominant asset in the heavy division on the conventional battlefield of the next century, it must have the RAH-66. Brigadier General Randall Rigby, Deputy Commandant of the Combined Arms Center, recently stated that shared situational awareness will be the "gunpowder of the 21st century."[106] It is the COMANCHE which will supply the ATKHB its portion of the 'gunpowder.' If the battalion is not expected to conduct 'Third Wave' warfare, then the COMANCHE is not a necessary investment.

[1] Headquarters, Department of the Army, Field Manual 100-5, Operations (Washington, D.C.: United States Government Printing Office, 1993), p. 2-21.

[2] Shelby L. Stanton, Anatomy of a Division: 1st Cav in Vietnam (Novato, CA: Presidio Press, 1987), p. 53.

[3] General Robert H. Scales et. al., Certain Victory: The US Army in the Gulf War (Fort Leavenworth, KS: Command and General Staff College Press, 1993), pp. 270-271.

[4] United States Army Aviation Center, Army Aviation in Desert Shield/Storm,draft (Fort Rucker, AL: United States Army Aviation Center, 1992), pp. 34-37.

[5] United States Army Aviation Center, Aviation Warfighting Treatise (Fort Rucker, AL: United States Army Aviation Center, 1993), p. 4.

[6] Ibid.

[7] Army Aviation in Desert Shield/Storm, p. 206.

[8] Headquarters, United States Army Training and Doctrine Command, TRADOC Pamphlet 525-5, Force XXI Operations: A Concept for Full-Dimensional Operations for the Strategic Army of the Early Twenty-first Century (Fort Monroe, VA: TRADOC, 1994), p. 4-6.

[9] General Gordon R. Sullivan, "Building the Force for the 21st Century--Force XXI," memorandum from the Chief of Staff of the Army, October 1994, p. 2.

[10] Lieutenant Colonel Rick Scales, "Aviation Restructure Initiative--The Way to the Future," Aviation Digest, September/October 1993, p. 15.

[11] Ibid.

[12] Information for Figure 1 drawn from:

Headquarters, Training and Doctrine Command, Aviation Requirements for the Combat Structure of the Army IV, (Fort Rucker, AL: United States Army Aviation Center, 1985), p. 4-6.

and

Headquarters, Department of the Army, Field Manual 1-112, Tactics, Techniques and Procedures for the Attack Helicopter Battalion (Washington, D.C.: United States Government Printing Office, 1990), p. 1-4.

[13] Headquarters, Department of the Army, Field Manual 1-111, Aviation Brigades (Washington, D.C.: United States Government Printing Office, 1990), p. 1-8.

[14] Headquarters, Department of the Army, Table of Organization and Equipment Number 0385L: Attack Helicopter Battalion; Division Aviation Brigade--Armored, Mechanized Infantry, Air Assault, and Infantry (except Light) Divisions; Attack Helicopter Regiment or Aviation Brigade (EAC); (Army of Excellence) (Washington, D.C.: Headquarters, Department of the Army, 1993), pp. 1807,1837,1870 .

[15] Directorate of Combat Developments, United States Army Aviation Center, Aviation Restructure Initiative: Foundation for the Future, yellow briefing book (Fort Rucker, AL: United States Army Aviation Center, 1994), inside cover.

[16] Scales, p. 14.

[17] United States Army Aviation Center, Employment of Aviation into the 21st Century (Fort Rucker, AL: United States Army Aviation Center, 1993), p. ii.

[18] TRADOC Systems Manager, LONGBOW, LONGBOW Lifts the Fog of War, information briefing (Fort Rucker, AL: TSM-LONGBOW, 1994), pages unnumbered.

[19] Aviation Restructure Initiative: Foundation for the Future, pp. 23-24.

[20] Information for Figure 2 drawn from:
Aviation Restructure Initiative: Foundation for the Future, pp. 23-24.

[21] Colonel David F. Sale and Captain Gregory J. Lund, "AH-64 APACHE Program Update," Aviation Digest, January/February 1993, pp. 14-15.

[22] LONGBOW Lifts the Fog of War.

[23] Aviation Restructure Initiative: Foundation for the Future, pp. 23-24.

[24] Alvin and Heidi Toffler, War and Anti-War (Boston, MA: Little, Brown, and Company, 1993), p. 64.

[25] Ibid., p. 71.

[26] Ibid., p. 72.

[27] Ibid., p. 38 to 43. The Tofflers' general thesis is that the way societies make war reflects the way they work (p. 33). Thus, agrarian societies gave rise to First Wave warfare, characterized by simple technology, organizations, and doctrine. Second Wave warfare emerged with the rise of the industrial revolution and is characterized by "mass destruction." Third Wave warfare is the child of the information age.

[28] Ibid., pp. 38, 66.

[29] Force XXI Operations, p. 1-5.

[30] Ibid., p. 2-7. The 'empty battlefield' phenomenon is a result of units increasing their dispersion on the battlefield to offset the increased lethality of weapon systems.

[31] FM 100-5, Operations, p. 2-10.

[32] Colonel Huba Wass de Czege, Understanding and Developing Combat Power (no publishing data available), p. 7.

[33] Ibid., pp. 12-14. Then Colonel Huba Wass de Czege developed a model for assessing combat potential using the dynamics of combat power. This study borrows heavily from his model in its assessments of the impact of change on the ATKHB's combat potential.

[34] Force XXI Operations, p. i.

[35] United States Army Aviation Center, Aviation Restructure Initiative. . . Modernizing for the Future, information briefing (Fort Rucker, AL: United States Army Aviation Center, 1994), p. 4.

[36] The battalion lacks both a fire support officer and a communications officer, nor is it resourced with a trained intelligence officer.

[37] TRADOC Analysis Center, Operations Analysis Center, Production Analysis Directorate, Aviation Attack Battalion Study: Final Report, Technical Report TRAC-TR-0993 (Fort Leavenworth, KS: TRADOC, 1993), p.3-19.

[38] Aviation Restructure Initiative. . . Modernizing for the Future, p. 4.

[39] Office of the Undersecretary of Defense for Policy, Conduct of the Persian Gulf War: Final Report to Congress (Washington, D.C.: United States Government Printing Office, 1992), pp. 669-670.

[40] Ibid.

[41] Sale and Lund, pp. 13-15.

[42] Headquarters, Department of the Army, Table of Organization and Equipment Number 0385A200: Attack Helicopter Battalion; Division Aviation Brigade--Armored, Mechanized Infantry, Air Assault, and Infantry (except Light) Divisions; Attack Helicopter Regiment or Aviation Brigade (EAC) (Washington, D.C.: Headquarters, Department of the Army, 1994), pp. 1-14, 20-26. The ARI makes manning changes in the staff, HHC, and AVUM company. The staff receives a communications-electronics staff officer (25C), a chaplain, and a flight surgeon. The S-3 and S-4 sections also receive minor additions in personnel. The HHC undergoes several changes. The most significant are a 25% increase in personnel in the automotive maintenance section and a 25% increase

in the III/V platoon. In addition, the HHC loses its command aviation section. The AVUM company's manning rises from 64 to 97 personnel, reflecting a change in the MARC manning level from 69% to 100%. This includes a 30% increase in personnel in both the aircraft maintenance platoon and the aircraft component repair platoon.

[43] Employment of Aviation into the 21st Century, pp. 2-3.

[44] Table of Organization and Equipment Number 0385A200: Attack Helicopter Battalion; Division Aviation Brigade--Armored, Mechanized Infantry, Air Assault, and Infantry (except Light) Divisions; Attack Helicopter Regiment or Aviation Brigade (EAC), pp. 15-19. The attack company's manning changes as a result of the consolidation to a single aircraft type . The aircrew members all become AH-64A qualified, and all crew chiefs become AH-64A maintainers. Additionally, the aerial observer section is eliminated from the aeroscout platoon. Each platoon receives a dedicated aviation life support equipment (ALSE) officer. The attack helicopter platoon receives a dedicated aircraft survivability equipment (ASE) officer. Overall, the company is reduced from 33 to 27 personnel.

[45] Employment of Aviation into the 21st Century, pp. 2-3.

[46] Information for Figure 3 drawn from:

United States Army Aviation Center, Attack Helicopter Operations, information briefing (Fort Rucker, AL: United States Army Aviation Center, 1994), pp. 14-16.

and

TRADOC Analysis Center, Operations Analysis Center, Production Analysis Directorate, Aviation Attack Battalion Study--Final Report (Fort Leavenworth, KS: TRAC, 1993), pp. 3-1 to 3-4.

[47] Lieutenant Colonel Laurence E. Thomas and Lieutenant Colonel Robert T. Gunning, "The Apache Helicopter," Army Aviation, November 1994, p. 31.

[48] Ibid.

[49] Sale and Lund, pp. 14-15.

[50] Information for Figure 4 was drawn from:

United States Army Aviation Center, Attack Helicopter Operations, information briefing (Fort Rucker, AL: United States Army Aviation Center, 1994), pp. 14-16.

and

FM 1-112, pp. 3-3 to 3-6.

Computations for both scout and attack weapons loads were based on Figure 3. The author used personal experience as an AH-64 attack helicopter company commander to select the most representative armament configuration for each mission. The deep attack mission profile requires an auxiliary fuel tank for all aircraft, thus lowering the attack helicopters' armament loads. In the heavy/light team profile, the heavy teams carry

the higher number of HFMs (both scout and attack) and the light teams carry the higher number of rockets.

[51] The battalion's FARP capability will tend to limit any significant increase in volume of fire over the long term. The addition of nine fuel and ammunition handlers should enable the FARPs to increase their 'turn around' capability in the short run. There is no increase in the battalion's ability to store and move ammunition and fuel, however, so the battalion cannot resupply its FARPs any faster. In fact, with the transfer of the UH-60s, the battalion loses its internal capability to conduct emergency resupply of its FARPs. Without an improved resupply capability, the battalion will only be able to sustain an increased volume of fire for limited durations.

Another potential limit on the volume of fire the battalion can generate is aircraft operational readiness. The AH-64A requires nearly five times as much maintenance as the OH-58C. While the increase in the maintainers per aircraft ratio and the streamlining of maintenance operations for a single aircraft type should offset some of the increased workload, the added AH-64As will challenge the battalion's maintenance capabilities. Operational readiness rates will probably remain about the same as they are now, which means that the battalion will only field three more AH-64As than it does now (using a standard operational readiness rate of 80 percent for aircraft).

[52] Information for Figure 5 drawn primarily from:
United States Army Aviation Center, Liaison Officer's Handbook, (Fort Rucker, AL: United States Army Aviation Center, 1994), p. 80.
and
Aviation Attack Battalion Study--Final Report, p. 3-9.
The author used personal experience to resolve conflicting planning factors.

[53] FM 100-5, p. 2-10 to 2-11.

[54] Aviation Warfighting Treatise, p. 11.

[55] Aviation Attack Battalion Study--Final Report , pp. 3-10 to 3-18.

[56] Ibid.

[57] Directorate of Training and Doctrine, United States Army Aviation Warfighting Center, AH-64D LONGBOW APACHE: Tactics, Techniques, and Procedural Methods of Employment (Fort Rucker, AL: United States Army Aviation Warfighting Center, undated), p. 23. (referred to hereafter as LONGBOW TTP).

[58] United States Army Aviation Warfighting Center, DCD, Study Branch, AH-64C/D Organizational Analysis Executive Summary (Fort Rucker, AL: United States Army Aviation Warfighting Center, 1993), p. 11. The results of this study suggest that the LONGBOW system provides a greater increase in combat potential to the attack helicopter battalion when employed on scout aircraft.

[59] TRADOC Systems Manager, LONGBOW, LONGBOW Lifts the Fog of War , information briefing (Fort Rucker, AL: TSM-LONGBOW, undated), p. ACDMOD.

[60] LONGBOW TTP, pp. 6-7.

[61] Ibid., pp. 5-14.

[62] Ibid., p. 5.

[63] Precise ranges for the LONGBOW FCR are not available at the time of this writing. The author estimated the information for Figure 6 available data.

[64] Ibid., pp. 4-5, 14-15.
and
LONGBOW Lifts the Fog of War, pp. 'How to Fight' section.

[65] LONGBOW TTP, p 25.

[66] LONGBOW Lifts the Fog of War, pp. 'How to Fight' section.

[67] Ibid., p. LBPERF2.

[68] In other words, the overhead in time of returning to the FARP reduces the volume of fire that the AH-64D and LONGBOW equipped battalion can produce over multiple missions to one similar to that of the AH-64A equipped battalion.

[69] Headquarters, Department of the Army, Field Manual 1-101, Aviation Battlefield Survivability, (Washington, D.C.: Headquarters, Department of the Army, 1990), p. A-41.

[70] LONGBOW Lifts the Fog of War, p. LBPERF2.

[71] Ibid., pp. 'How to Fight' section.

[72] Major General Dewitt T. Irby, Jr., "Army Aviation Modernization," Army Aviation, March-April 1994, p. 32.

[73] LONGBOW TTP, pp. 9-20.

[74] LONGBOW Lifts the Fog of War, p. POTCAP.

[75] Ibid.

[76] FM 100-5, p. 2-11.

[77] Thomas and Gunning, p. 33. The AH-64D will be able to receive intelligence data from any source equipped with the tri-service IDM and SINCGARS radios. It has already successfully received digital information from the E-8B Joint Surveillance Target Attack Radar System (JSTARS) at distances exceeding 100 nautical miles.

[78] Ibid., p. STANDOFF.

[79] FM 100-5, p. 2-11.

[80] AH-64C/D Organizational Analysis Executive Summary , pp. 9-10, 19-20.

[81] Ibid.

[82] Aviation Restructure Initiative: Foundation for the Future, pp. 23-24.

[83] TRADOC Systems Manager, RAH-66 COMANCHE, RAH-66 COMANCHE Information Briefing (Fort Rucker, AL: TSM-COMANCHE, undated), p. N 4216 18.

[84] Ibid., p. N 4216 30.

[85] Ibid.

[86] Frank Colucci, "Suppressed to Survive," Defense Helicopters, volume II, number 3, July-September 1992, p. 45.

[87] RAH-66 COMANCHE Information Briefing, p. N 4216 30.

[88] Irby, p. 22.

[89] Lieutenant Colonel Rich Langhorst, "The COMANCHE Crew Support System," Army Aviation, June 1994, pp. 24-27, 64.

[90] RAH-66 COMANCHE Information Briefing, p. N 4216 29.

[91] Major General John D. Robinson, "Comanche--A New Weapon System for a New Age," Army Aviation, June 1994, p. 7.

[92] RAH-66 COMANCHE Information Briefing., p. N 4216 24.

[93] Ibid., p. N 4216 21.

[94] Ibid, p. N 4216 32.

[95] United States Government Accounting Office, National Security and International Affairs Division, Comanche Helicopter: Program Needs Reassessment Due to Increased Unit Cost and Other Factors, Report to the Chairman and Ranking Republican Member,

Subcommittee on Investigations, Committee on Armed Services, House of Representatives (Washington, D.C.: USGAO, 1992), pp. 4, 23.

[96] FM 100-5, p. 2-11.

[97] Ibid.

[98] Ibid.

[99] FM 100-5, pp. 2-11 to 2-15.

[100] Aviation Warfighting Treatise, p. 6.

[101] FM 1-112, p. 1-3.

[102] Uses readiness rate of twelve AH-64Ds and six RAH-66s. Attack helicopter are using an auxiliary fuel tank and are armed with eight HFMs each. Scouts are also using an auxiliary fuel tank and armed with six HFMs each. Assumes a probability of hit of 80 percent.

[103] Thomas and Gunning, p. 33.

[104] Ibid. LONGBOW prototypes have already successfully passed and received digital information via their UHF-AM secure radios to the EA-8B JSTARS at distances exceeding 100 nautical miles.

[105] Honorable Togo D. West, in a speech to the faculty and students of the School of Advanced Military Studies, 7 December 1994.

[106] Brigadier General Randall Rigby, Deputy Commandant, Combined Arms Center, in a speech to the faculty of the Command and General Staff College, 1 December 1994.

Appendices

Appendix A: Selected Aircraft Capabilities/Planning Factors--OH-58C

Appendix B: Selected Aircraft Capabilities/Planning Factors--AH-64A

Appendix C: Selected Aircraft Capabilities/Planning Factors--AH-64A(+)

Appendix D: Selected Aircraft Capabilities/Planning Factors--AH-64D/LONGBOW

Appendix E: Selected Aircraft Capabilities/Planning Factors--RAH-66 COMANCHE

Appendix F: Combat Power Model

Appendix A: Aircraft Specifications/Planning Factors--OH-58C

1. General. The OH-58C KIOWA was developed as an aeroscout during the Vietnam War. It is a single-engine helicopter with no advanced systems of any type. The following specifications and planning factors were drawn from a number of sources and represent compromises between them.

2. References:

a. Field Manual 1-101, Aviation Battlefield Survivability. Washington, D.C.: Headquarters, Department of the Army, 1993.

b. Field Manual 1-112, Tactics, Techniques and Procedures for the Attack Helicopter Battalion. Washington, D.C.: Headquarters, Department of the Army, 1991.

c. Technical Manual 55-1520-228-10, Operators Manual for Army Model OH-58A/C Helicopter. Washington, D.C.: Headquarters, Department of the Army, 1989.

d. TRADOC Analysis Center, Operations Analysis Center, Production Analysis Directorate. Aviation Attack Battalion Study--Final Report. Fort Leavenworth, KS: TRAC, 1993.

e. United States Army Aviation Center, Army Aviation in Desert Shield/Storm . Draft. Fort Rucker, AL: United States Army Aviation Center, 1992.

3. Selected Specifications/Planning Factors.

Range: 481 km.

Speed: 185 kph (cruise)

Endurance:

2.6 hours
3.5 hours with aux. tank (23.9 gal.)

Pilotage:

Day-visual (unaided)
Night- AN/AVS-6 night vision goggles
Radar Altimeter

Navigation:

Paper map
LORAN or GPS (special modification only)

Target Acquisition:
Visual (unaided, day; AN/AVS-6, night)
-Detection range: 2-3 km (day)/ 0.5 km (night)
-Identification range: 1 km (day)/ 0.4 km (night)
Target Designation:
None

Target Handover:
Voice (radio)
Visual signals

Fire Control/Distribution:
Voice (radio)
Premission planning

Weapon Systems:
Air-to-air Stinger (ATAS)--max 4
(limited number of aircraft per battalion equipped with ATAS)

Communications:
1 x FM (secure)
1 x FM (non-secure)
1 x VHF (non-secure)
1 x UHF (Have Quick)

Aircraft Survivability Equipment:
AN/APR-39 Radar Warning Receiver
Identification Friend or Foe Transponder
Infrared Exhaust Suppressors

Maintenance:
Maintenance Manhours/Flight Hour = 3.5

Fuel Consumption:
27 gph

Transportability:
Airlift:
Number per C-5 = 13
per C-141 = 6
Sealift: ship board compatible
Aircraft Recovery by: UH-1, UH-60, CH-47

Mission Planning/Rehearsal/Debrief Support:
Manual only

Appendix B: Aircraft Specifications/Planning Factors--AH-64A

1. General. The U.S. Army fielded the AH-64A APACHE in the mid-1980s. It is a dual-engine helicopter with many advanced systems. It is the Army's most advanced attack helicopter. The following specifications and planning factors were drawn from a number of sources. The author compromised between them based on personal experience.

2. References:

a. Field Manual 1-101, Aviation Battlefield Survivability. Washington, D.C.: Headquarters, Department of the Army, 1993.

b. Field Manual 1-112, Tactics, Techniques and Procedures for the Attack Helicopter Battalion. Washington, D.C.: Headquarters, Department of the Army, 1991.

c. Technical Manual 55-1520-238-10, Operators Manual for Army AH-64A Helicopter. Washington, D.C.: Headquarters, Department of the Army, 1984.

d. TRADOC Analysis Center, Operations Analysis Center, Production Analysis Directorate. Aviation Attack Battalion Study--Final Report. Fort Leavenworth, KS: TRAC, 1993.

e. United States Army Aviation Center, Army Aviation in Desert Shield/Storm . Draft. Fort Rucker, AL: United States Army Aviation Center, 1992.

f. Thomas, Laurence E. and Gunning, Robert T. "The Apache Helicopter," Army Aviation. November 1994:.

g. United States Army Aviation Center, Liaison Officer's Handbook. Fort Rucker, AL: United States Army Aviation Center, 1994.

3. Selected Specifications/Planning Factors.

Range: 500 km.
700 km. (with 1 aux. fuel tank)
1833 km (with 4 aux. fuel tanks)

Speed:
. 268 kph (cruise)

Endurance:

2.1 hours
+1.3 hours per 230 gal. aux. fuel tank (4 max)

Pilotage:

Day-visual (unaided)
Night- (primary) Pilot Night Vision System (FLIR)
(secondary) AN/AVS-6 night vision goggles

Radar Altimeter
Digital Automatic Stabilization Equipment
Heading and Attitude Reference System

Tactical Navigation:

Paper map
AN/ASN-128 Doppler Navigation Set
Heading and Attitude Reference System
GPS (ad hoc modification)

Target Acquisition:

Target Acquisition and Designation System
-Direct View Optics (DVO)
-Day Television (DTV)
-Forward Looking Infrared (FLIR)

Range to:	Detect	Classify	Identify
DVO			
DTV	10+ km.	8-10 km.	5-7 km.
FLIR	10+ km.	5-6 km.	2-3 km.

(FLIR ranges are condition dependent)

Laser Spot Tracker (LST)

Target Designation:

Laser Rangefinder/Designator (LRF/D)

Target Handover:

Voice (radio)
Visual signals

Fire Control/Distribution:

Voice (radio)
Premission planning
LRF/D and LST
TADS Waypoint/Targeting Function

Weapon Systems:

Point targets--

Hellfire Missile System (ATGM)

-range: 8 km.
-laser designated
-max load: 16 Hellfire Missiles
-high explosive anti-tank

Area targets--

2.75 inch Aerial Rocket Control System

-range: 6.6 to 9 km.
-max load: four 19-shot pods (76 rockets)
-variety of munitions

30 mm Area Weapon System (cannon)

-range: 4 km.
-max load: 1200 rounds
-high explosive dual purpose

Communications:

1 xVHF/FM (secure)
1 x VHF/FM (non-secure)
1 x UHF (Have Quick)

Aircraft Survivability Equipment:

AN/APR-39(V)1 Radar Warning Receiver
AN/APX-100(V)1 Identification Friend or Foe Transponder
AN/VDR-2 Laser Warning Receiver
AN/ALQ-136 Radar Jammer
AN/ALQ-144 Infrared Jammer
M130 Chaff Dispenser
Infrared Suppression System

Maintenance:

Maintenance Manhours/Flight Hour = 15.0

Fuel Consumption:

175 gph

Transportability:

Airlift:

Number per C-5 = 6
per C-141 = 2

Sealift: ship board compatible

Aircraft Recovery by: CH-47

Mission Planning/Rehearsal/Debrief Support:
Premission/Manual
Video Recording System (debrief)

Appendix C: Aircraft Specifications/Planning Factors--AH-64A(+)

1. General. The AH-64A(+) is an upgrade of the current AH-64A. Very little information is available on exact specifications. This study assumes they will be approximately the same as the AH-64A except where known improvements were made.

2. Selected Specifications/Planning Factors.

Range: 500 km.
700 km. (with 1 aux. fuel tank)
1833 km (with 4 aux. fuel tanks)

Speed: 268 kph (cruise)

Endurance:
2.1 hours
+1.3 hours per 230 gal. aux. fuel tank (4 max)

Pilotage:
Day-visual (unaided)
Night- (primary) Pilot Night Vision System (FLIR)
(secondary) AN/AVS-6 night vision goggles

Radar Altimeter
Digital Automatic Stabilization Equipment
Heading and Attitude Reference System

Tactical Navigation:
Paper map
AN/ASN-128 Doppler Navigation Set
Heading and Attitude Reference System
GPS (embedded)

Target Acquisition:
Target Acquisition and Designation System
-Direct View Optics (DVO)
-Day Television (DTV)
-Forward Looking Infrared (FLIR)

Range to:	Detect	Classify	Identify
DVO			
DTV	10+ km.	8-10 km.	5-7 km.
FLIR	10+ km.	5-6 km.	2-3 km.

(FLIR ranges are condition dependent)

Laser Spot Tracker (LST)

Target Designation:
Laser Rangefinder/Designator (LRF/D)

Target Handover:
Voice (radio)
Visual signals

Fire Control/Distribution:
Voice (radio)
Premission planning
LRF/D and LST
TADS Waypoint/Targeting Function

Weapon Systems:
Point targets--
Hellfire Missile System (ATGM)
-range: 8 km.
-laser designated
-max load: 16 Hellfire Missiles
-high explosive anti-tank

Area targets--
2.75 inch Aerial Rocket Control System
-range: 6.6 to 9 km.
-max load: four 19-shot pods (76 rockets)
-variety of munitions
30 mm Area Weapon System (cannon)
-range: 4 km.
-max load: 1200 rounds
-high explosive dual purpose

Communications:
1 xVHF/FM (secure; SINCGARS)
1 x VHF/FM (non-secure; SINCGARS)
1 x UHF (Have Quick)
1 x HF

(note: A(+) modifications relocate antennas for improved nap of the earth communication.)

Aircraft Survivability Equipment:

AN/APR-39(V)1 Radar Warning Receiver
AN/APX-100(V)1 Identification Friend or Foe Transponder
AN/VDR-2 Laser Warning Receiver
AN/ALQ-136 Radar Jammer
AN/ALQ-144 Infrared Jammer
M130 Chaff Dispenser
Infrared Suppression System

Maintenance:

Maintenance Manhours/Flight Hour = 15.0

Fuel Consumption:

175 gph

Transportability:

Airlift:

Number per C-5 = 6
per C-141 = 2

Sealift: ship board compatible

Aircraft Recovery by: CH-47

Mission Planning/Rehearsal/Debrief Support:

Premission/Manual
Video Recording System (debrief)

Appendix D: Aircraft Specifications/Planning Factors--AH-64D/ LONGBOW

1. General. Few sources exist with precise capabilities for the AH-64D or the LONGBOW system. The author assumes many of the planning factors will remain similar to those of the AH-64A where specific systems have not been upgraded.

2. References:

a. Technical Manual 55-1520-238-10, Operators Manual for Army AH-64A Helicopter. Washington, D.C.: Headquarters, Department of the Army, 1984.

b. United States Army Aviation Warfighting Center, Directorate of Combat Developments, Study Branch, AH-64C/D Organizational Analysis Executive Summary. Fort Rucker, AL: United States Army Aviation Warfighting Center, 1993.

c. United States Government Accounting Office, National Security and International Affairs Division, Comanche Helicopter: Program Needs Reassessment Due to Increased Unit Cost and Other Factors. Report to the Chairman and Ranking Republican Member, Subcommittee on Investigations, Committee on Armed Services, House of Representatives. Washington, D.C.: GAO, 1992.

d. Irby, Dewitt T., Jr. "Army Aviation Modernization," Army Aviation. March-April 1994: 22-32.

e. Neilson, Harold K. "Longbow Apache: The Year of the Test." Army Aviation. May 1994: 21-28.

f. Sale, David F. and Lund, Gregory J. "AH-64 APACHE Program Update," Aviation Digest, January/February 1993: 13-16.

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h. Office of the Assistant Secretary of the Army (Research, Development, and Acquisition). Weapon Systems: United States Army 1994. Washington, D.C.: United States Government Printing Office, 1994.

i. TRADOC Systems Manager, LONGBOW, LONGBOW Weapon System. Fact Sheet. Fort Rucker, AL: TSM-LONGBOW, 30 March 1994.

j. United States Army Aviation Warfighting Center, Directorate of Training and Doctrine, AH-64D Longbow Apache: Tactics, Techniques, and Procedural Methods of Employment. Fort Rucker, AL: United States Army Aviation Warfighting Center, undated.

3. Selected Systems/Specifications/Planning Factors.

Range: 500 km.
700 km. (with 1 aux tank)
1833 km (with 4 aux. fuel tanks)

Speed: 268 kph (cruise)

Endurance:
2.1 hours
+1.3 hours per 230 gal. aux. fuel tank (4 max)

Pilotage:
Day-visual (unaided)
Night- Pilot Night Vision System
Image Intensification (I2; embedded)

Radar Altimeter
Terrain Profiling Mode (millimeter wave radar function)
Digital Automatic Stabilization Equipment

Tactical Navigation:
Paper map
Inertial Navigation System/GPS/Doppler (integrated; embedded)
'Strip map' graphics on multi-function display

Target Acquisition:
Fire Control Radar (millimeter wave radar; automatic target detection and classification)
Radio Frequency Interferometer (radar emitting targets)
Target Acquisition and Designation System
-Day Television (DTV)
-Forward Looking Infrared (FLIR)

Range to:	Detect	Classify	Identify
FCR	10+ km.	8+	
RFI	10+ km.	8+	
DTV	10+ km.	8-10 km.	5-7 km.
FLIR	10+ km.	5-6 km.	2-3 km.

(FLIR ranges are condition dependent)

Laser Spot Tracker (LST)

Target Designation:
Fire Control Radar
Laser Rangefinder/Designator (LRF/D)

Target Handover:
Enhanced Airborne Target Handover System
Voice (radio)
Visual signals

Fire Control/Distribution:
Voice (radio)
Premission planning
LRF/D and LST
TADS Waypoint/Targeting Function
FCR/EATHS Battle Management Function (fire control/distr.)
'Tactics Expert' Function (target prioritization)

Weapon Systems:
Point targets--
Longbow Hellfire Modular Missile System (ATGM)
-range: 8 km.
-designation: laser or millimeter wave radar
-max load: 16 Hellfire Missiles
-high explosive anti-tank

Area targets--
2.75 inch Aerial Rocket Control System
-range: 6.6 to 9 km.
-max load: four 19-shot pods (76 rockets)
-variety of munitions
30 mm Area Weapon System (cannon)
-range: 4 km.
-max load: 1200 rounds
-high explosive dual purpose

Communications:
1 xVHF/FM (secure; SINCGARS)
1 x VHF/FM (non-secure; SINCGARS)
1 x UHF (Have Quick)
1 x HF

Improved Data Modem

EATHS

Aircraft Survivability Equipment:
AN/APR-39 A(V)1 Radar Warning Receiver
AN/APX-100(V)1 Identification Friend or Foe Transponder
AN/VDR-2 Laser Warning Receiver
AN/ALQ-136 (V5)Radar Jammer
AN/ALQ-144 (V3) Infrared Jammer
M-130 Chaff Dispenser
Infrared Suppression System
Radio Frequency Interferometer
MANPRINT Cockpit

Maintenance:
Maintenance Manhours/Flight Hour = 15.0 (approx.)

Fuel Consumption:
175 gph

Transportability:
Airlift:
Number per C-5 = 6
per C-141 = 2

Sealift: ship board compatible

Aircraft Recovery by: CH-47

Mission Planning/Rehearsal/Debrief Support:
Aviation Mission Planning Station
Data Transfer Module
Onboard Mission Rehearsal Function
Battle Management Function
Video Recording System (debrief)

Appendix E: Aircraft Specifications/Planning Factors--RAH-66 COMANCHE

1. General. The RAH-66 COMANCHE was designed to replace the aging fleets of OH-58s, OH-6s, and AH-1s. Designed specifically as a scout helicopter, it will bring a quantum leap in capabilities to the aeroscout role.

2. References:

a. United States Government Accounting Office, National Security and International Affairs Division, Comanche Helicopter: Program Needs Reassessment Due to Increased Unit Cost and Other Factors. Report to the Chairman and Ranking Republican Member, Subcommittee on Investigations, Committee on Armed Services, House of Representatives. Washington, D.C.: GAO, 1992.

b. Langhorst, Rich. "The COMANCHE Crew Support System," Army Aviation. June 1994: 24-27, 64.

c. Mullen, Orlin L. "RAH-66 Comanche Program Manager's Update." Army Aviation. June 30, 1994: 11-18.

d. TRADOC Systems Manager, RAH-66 Comanche, RAH-66 COMANCHE Capabilities Briefing. Fort Rucker, AL: TSM-Comanche, undated.

e. TRADOC Systems Manager, RAH-66 Comanche, RAH-66 COMANCHE Information Briefing. Fort Rucker, AL: TSM-Comanche, undated.

f. Office of the Assistant Secretary of the Army (Research, Development, and Acquisition). Weapon Systems: United States Army 1994. Washington, D.C.: United States Government Printing Office, 1994.

3. Selected Systems/Specifications/Planning Factors.

Range:
500 km.
2333 km (with 4 aux. fuel tanks)

Speed: 314 kph (cruise)

Endurance:
3 hours

Pilotage:

Day-visual (unaided)
Night- Pilot Night Vision System (2d generation FLIR)
Image Intensification (I2; embedded)

Radar Altimeter
Terrain Profiling Mode (millimeter wave radar function)
Digital Automatic Stabilization Equipment

Tactical Navigation:

Paper map
Inertial Navigation System/GPS/Doppler (integrated; embedded)
Digitized mapand graphics on multi-function display

Target Acquisition:

Fire Control Radar (millimeter wave radar; automatic target detection and classification)
Radio Frequency Interferometer (radar emitting targets)
Target Acquisition and Designation System
-Day Television (DTV)
-Forward Looking Infrared (FLIR; 2d generation)

Range to:	Detect	Classify	Identify
FCR	10+ km.	8+	
RFI	10+ km.	8+	
DTV	10+ km.	8-10 km.	5-7 km.
FLIR	15+ km.	10-12 km.	4-6 km.

(FLIR ranges are estimated based on expected improvement)

Laser Spot Tracker (LST)

Target Designation:

Fire Control Radar
Laser Rangefinder/Designator (LRF/D)

Target Handover:

Enhanced Airborne Target Handover System
Voice (radio)
Visual signals

Fire Control/Distribution:

Voice (radio)
Premission planning
LRF/D and LST
TADS Waypoint/Targeting Function

FCR/EATHS Battle Management Function (fire control/distr.)
'Tactics Expert' Function (target prioritization)

Weapon Systems:

Point targets--

Longbow Hellfire Modular Missile System (ATGM)

-range: 8 km.
-designation: laser or millimeter wave radar
-max load: 14 Hellfire Missiles
-high explosive anti-tank

Air-to-air Missile (ATAM)

-assumed comparable to Stinger
-max load: 18 ATAM

Area targets--

2.75 inch Aerial Rocket Control System

-range: 6.6 to 9 km.
-max load: two19-shot pods and six 4-shot pods (62 rockets)
-variety of warheads

20 mm Area Weapon System (Vulcan II gatling gun)

-range: 4 km.
-max load: 500 rounds
-high explosive dual purpose

Communications:

1 xVHF/FM (secure; SINCGARS)
1 x VHF/FM (non-secure; SINCGARS)
1 x UHF (Have Quick)
1 x HF

Improved Data Modem
EATHS

Aircraft Survivability Equipment (some optional):

Low Observable Materials
AN/APR-39 A(V)1 Radar Warning Receiver
AN/APX-100(V)1 Identification Friend or Foe Transponder
AN/VDR-2 Laser Warning Receiver
AN/ALQ-136 (V5)Radar Jammer
AN/ALQ-144 (V3) Infrared Jammer
M-130 Chaff Dispenser
Infrared Suppression System
Radio Frequency Interferometer
MANPRINT Cockpit

Maintenance:

Maintenance Manhours/Flight Hour = 2.6 (requirement)

Fuel Consumption:

90gph

Transportability:

Airlift:

Number per C-5 = 8

per C-141 = 3

Sealift: ship board compatible

Aircraft Recovery by: CH-47

Mission Planning/Rehearsal/Debrief Support:

Aviation Mission Planning Station
Data Transfer Module
Integrated Mission Support System
Video Recording System (debrief)

Appendix F: Wass de Czege Combat Power Model

Firepower effect, which is a function of:

Volume of fire (rate of fire, supply, number of weapon systems).
Lethality of munitions (explosive energy, design characteristics).
Accuracy of fires (weapon design, crew proficiency, terrain effects, visibility).
Target acquisition (intelligence, positioning of observers/sensors, transmission of target data).
Flexibility of employment (weapon ranges, mobility, signature effects, fire control systems, tactical employment doctrine).

Maneuver effect, which is a function of:

Unit mobility (physical fitness, teamwork, equipment capabilities, maintenance, mobility skills).
Tactical Analysis (intelligence, IPB, understanding own capabilities).
Management of resources (equipment, supplies, personnel, time, energy).
Command, control, and communications(span of control, staff efficiency, SOPs and doctrine, communication efficiency).

Protection effect, which is a function of:

Concealment (camouflage, stealth, equipment design, counter-enemy intelligence means).
Exposure limitation (minimize target size and exposure time, complicate tracking).
Damage limitation (use cover, vehicle design, recovery and treatment, redundant systems).

Leadership effect, which is a function of:

Technical proficiency.
Understanding unit capabilities.
Communications skills.
Dedication, commiment, and moral force.
Understanding battlefield effects.

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